



PSC Overview Series . . . Electric Transmission Lines

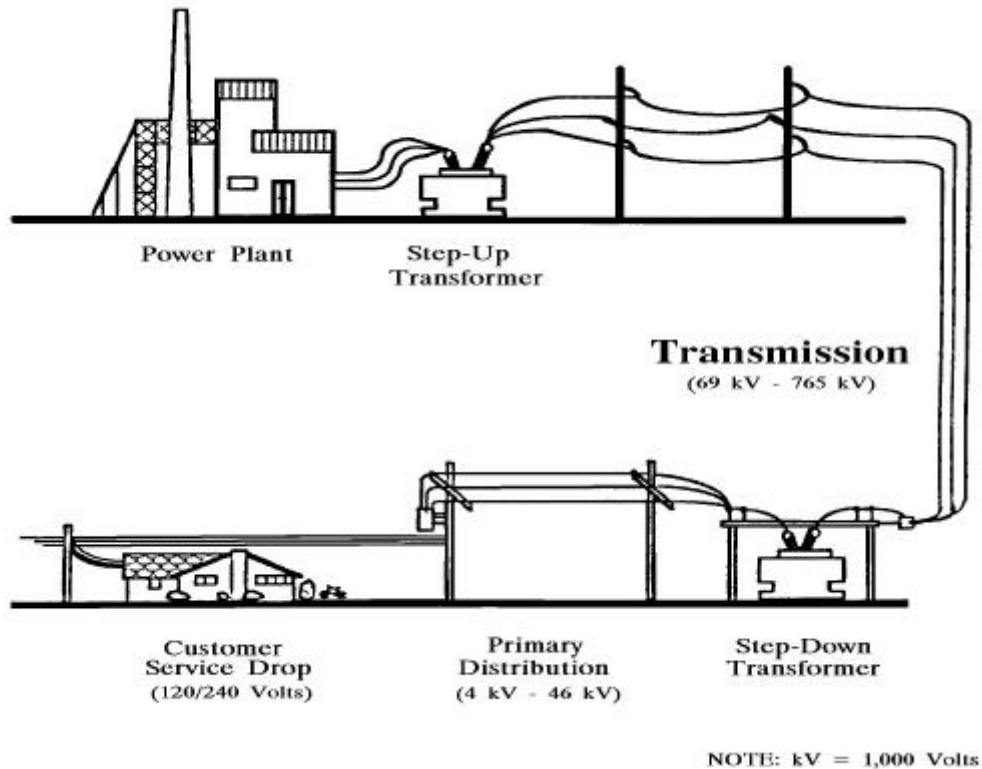
This overview presents basic information about electric transmission lines for landowners, government officials, and other members of the public who expect transmission construction in their area.

Electricity—From the Power Plant to the Customer

Electric lines transport electricity from power plants to customers. Figure 1 shows the electric system. The three types of electric lines are:

- customer *service connections*, which operate at a few hundred volts and serve several customers;
- local *distribution lines*, which operate at a few thousand volts and serve several thousand customers;
- *transmission lines*, which may operate at several hundred thousand volts and serve several hundred thousand customers.

Figure 1 Simplified electrical system



The lines that generate the most public interest are transmission lines. These are the largest and most visible electric lines. They operate at the highest voltages and can carry the most power. A large transmission line may supply the electric needs of a large city. Most large cities require several transmission lines for reliable electric service.

Transmission lines throughout Wisconsin and the surrounding states form a regional transmission “network.” This network operates as one system. Power flows over lines, regardless of ownership, to provide energy wherever it is needed.

In a typical year, utilities build or upgrade 100 to 200 miles of transmission lines in Wisconsin.

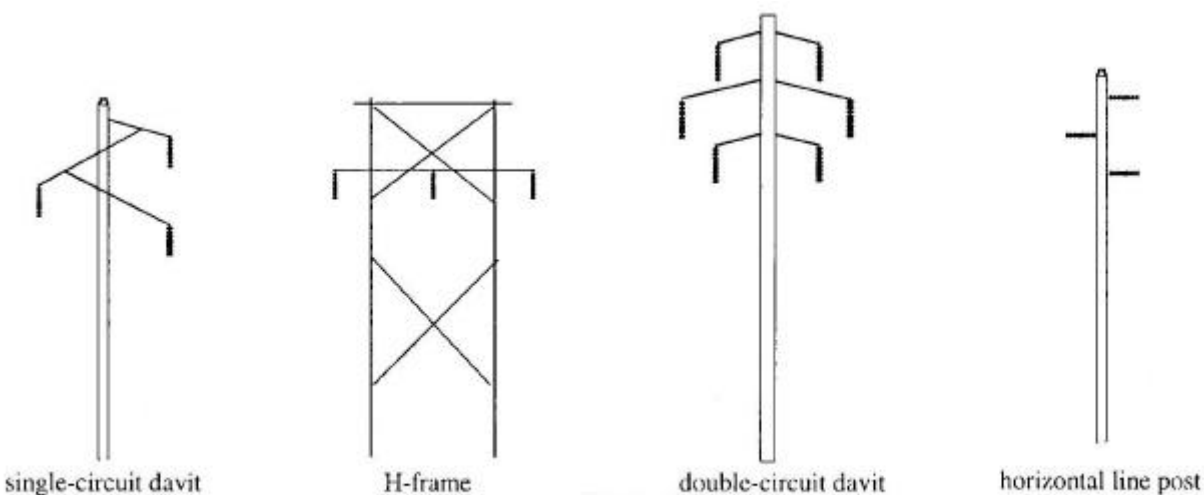
This overview presents information about transmission lines and the PSC review and approval process.

Transmission Line Design

Transmission lines are usually much larger than the more common distribution lines that run along rural roads and city streets. Transmission line poles, or structures, are between 60 and 100 feet tall; distribution line poles are around 40 feet tall. Figure 2 shows typical transmission structures used for new lines.

On a transmission structure, the three large wires, called conductors, carry electric power. They are usually about an inch in diameter. There also is a smaller wire at the top of the structure, called the shield wire, which protects the power line from lightning. Occasionally, utilities design a transmission structure to carry two separate sets of transmission lines. This “double-circuit” structure carries six conductors and one or two shield wires.

Figure 2 Typical electric line structures in Wisconsin



The “design” of a transmission line typically ranges from 46,000 volts to 345,000 volts. The term “kilovolt,” or “kV,” stands for 1,000 volts. The highest transmission voltage in Wisconsin, 345,000 volts, is usually referred to as 345 kV. Higher voltage lines are found in other areas of the U.S.

Transmission Line Needs

The need for new transmission lines is generally linked to growth in the use of electricity. This means that:

- Utilities must reinforce the existing transmission system with new lines to prevent equipment overloads and low voltages.
- New power plants may need to be built, with new transmission lines to connect them to the existing transmission system.
- Older transmission lines that are in poor condition and no longer reliable might need to be replaced by new lines.

In 1992, the PSC recognized “power transfer capability” as an acceptable reason for building new lines. Power transfer capability means the ability to transfer, or exchange, power between regions of the state or between Wisconsin and other states. This capability is over and above the capacity to transport and deliver electricity to “native” customers in a utility’s service territory.

Power transfer benefits can include:

- increased transmission system reliability;
- sale of “firm” power;
- sale off non-firm “economy” power when market prices are favorable to both parties; and
- exchange of power during emergencies.

Changes in transmission use

The Federal Energy Regulatory Commission (FERC), a federal agency that regulates energy utilities, has ordered utilities to offer fair and open access for other energy providers to use their transmission lines. This recognizes that the transmission system operates as one network and that one utility’s electricity often flows over other utilities’ lines. It also recognized the monopoly characteristics of transmission lines. By sharing the use of transmission lines, utilities can more easily buy power when and where it is economic. This helps keep customer rates low. As more wholesale transactions (and perhaps retail in the future) occur, the demand for transfer capacity on the transmission system will increase.

In April 1996, FERC required the utilities to file “open access” tariffs (rates) to allow other entities, including competitors, to use the utilities’ systems to move wholesale power. Public utilities that own, control, or operate interstate transmission facilities are now required to offer for sale to others the same transmission service they provide themselves. The PSC had already required major Wisconsin utilities to have such tariffs approved by FERC. The PSC and FERC continue to explore ways for the transmission systems to allow the wholesale generation market to develop. One such effort is the development of an Independent System Operator (ISO) for the transmission system. An ISO would operate and control the transmission system to ensure that the system was available on a fair and equal basis to all buyers and sellers. Several ISO proposals are being considered for Wisconsin and the surrounding region. FERC approval is required before an ISO takes control of the transmission system. The recently passed Reliability Bill, 1997 Wisconsin Act 204, requires all Wisconsin transmission utilities to transfer control of assets to an ISO or divest all transmission assets to an independent transmission owner.

PSC Role

The PSC is the branch of state government with the overall responsibility of regulating electric utilities. The PSC reviews all proposed transmission projects whose cost exceeds \$5 million. Utilities cannot begin construction of large high-voltage lines (greater than 200 kV or greater than 100 kV with at least one mile of new right-of-way) until receiving a Certificate of Public Convenience and Necessity (CPCN) from the PSC. The PSC considers need, engineering, economics, safety, reliability, individual hardships, and environmental factors when reviewing a transmission project. The CPCN review process also includes a public hearing held in the affected project area.

Transmission planning

Because the transmission system is an interconnected network that functions as one system, the utilities need to cooperate in planning power lines and substations. Following PSC-approved steps, utility engineers work together using computer simulations of the transmission system to determine the need for new transmission lines. These simulations look about 15 years into the future to test how transmission facility outages (due, for example, to a lightning storm or tornado) will affect customer voltages and electric power flows on other transmission lines. If these studies show that the transmission system is vulnerable to low voltages or line overloads in the future, the utilities will generally conclude that the transmission system must be reinforced. Usually this means building a new transmission line. When applying for construction approval the utilities provide basic electric, environmental, and cost data for a number of transmission solutions.



Final Transmission Line Routes

The PSC selects the best route when it issues an order granting a CPCN. The PSC can deny the CPCN based on lack of need or lack of a viable route. The PSC can direct the utilities to build for a particular voltage, to use a particular structure type, and to minimize environmental impacts.

Route alternatives

The utility provides information on more than one possible route in its application. Many utilities sponsor public meetings and base the proposed routes in their application on information they gather at these meetings. In addition, the utilities gather data from public agencies, maps, air photos and driving and walking over the project area.

A utility may or may not identify a preferred or proposed route. It must provide the PSC with equal information on all reasonable routes, and the PSC, during its review, treats all the routes equally. The route finally chosen may be the utility proposal, a combination of reasonable routes, a variation of a reasonable route, or a route which was suggested by a member of the public.

Route approval

The PSC reviews the project area and the utilities' routing information and considers other possible routes or transmission structures. The PSC considers the area that would actually be affected by each route, the quality of the existing environment, the types of impacts a power line would cause in this area, the degree of impact, and possible ways to minimize impacts.



For a more in-depth discussion of this issue, see the Overview “Environmental Impacts of Electric Transmission Lines.”

The PSC looks for potential impacts to these resources and others: aesthetics, agriculture, airports and airstrips, archeological sites, cultural and social characteristics of the project area, endangered/threatened resources, forests, historic sites, property values, recreation areas, river crossings, safety, and wetlands. The PSC also examines the potential changes in magnetic fields that could result from the project.

The PSC also looks into possibilities for locating the new lines near existing power lines, railroads or roads (this is called corridor-sharing). In addition, route choices may be affected by other factors reviewed by the PSC, such as transmission system reliability and costs.

Based on information gained from the review process and public comments, the Commission decides which route the new line will follow.

New Lines and Landowners

A utility will negotiate with landowners to obtain an easement on which to build the power line. There are a number of laws and rules related to landowner rights (such as the right to prevent the utilities from applying herbicides to the power line right-of-way). For power lines under 100 kV, the utility can begin negotiations before getting any necessary approvals from the PSC. For power lines 100 kV or over, the utility must first acquire a CPCN unless the line is in existing transmission right-of-way (ROW).

The Department of Commerce has jurisdiction over the easement negotiation process, because utilities have the power of eminent domain to build transmission lines. This means that a landowner cannot refuse to work out an agreement for an easement. The utility can take the landowner to court and have the court set the price for the easement and condemn land for the easement.

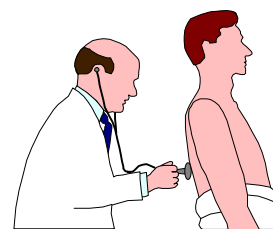
The PSC generally approves utility “corridors” or “routes,” whose location may be precisely described or only generally described, depending on the circumstances. The PSC order may also set objectives for utilities, such as placing structures as close to the road ROW as possible or working with the DNR to route a line through a wetland area. The PSC has no part in negotiations or in the exact placement of transmission structures. The PSC’s objective is to provide direction, but to allow individual landowners and utilities the flexibility to work out specific details, related to individual circumstances and preferences.

For more information, refer to the Overview on rights-of-way and easements for transmission line projects.

Human Health Impacts

Part of the National and Wisconsin electrical codes protect people and property from electrical shocks by providing standards for safe construction and operation of transmission lines.

Some scientific studies suggest there is a link between magnetic fields, which are generated by power lines as well as household wiring and appliances, and certain types of cancer.

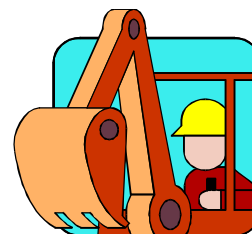


In October 1996, the National Research Council completed a study of research on magnetic fields since 1979. It concluded that the evidence so far “does not show that exposure to these fields presents a human health hazard.” The Council also suggested several specific research projects that might improve knowledge about health effects.

For a more in-depth discussion of this issue, see the Overview “EMF: Electric and Magnetic Fields.”

Underground Transmission Lines

Small distribution lines are routinely buried. The burial of large transmission lines is less common because it is extremely expensive, from 2 to 10 times more than overhead construction.



Over the long term, underground transmission cables may not be as reliable as overhead lines. It takes longer to locate and correct problems on underground transmission lines. A faulted line might be out of service for several days. Sometimes, a fourth conductor must be added as a spare, or a whole second circuit must be included to guard against extended power loss.

Underground construction may result in greater environmental impact than overhead construction because of the extensive land clearing and excavation that may be required. Trees and bushes, for instance, must be kept away from an underground line. Their roots attract water from the soil around the line and reduce the soil's ability to wick the line's heat away to the air above. Under overhead lines, small trees and bushes may be planted. Also, excavation is limited to the location of each of the overhead structures.

There are three basic kinds of underground transmission construction commonly used: (1) in high-pressure, oil-filled pipe; (2) in high-pressure, gas-filled pipe; and (3) as solid polyethylene-coated cables either buried directly or inside PVC ducts encased in a concrete envelope. Each has advantages and disadvantages. Oil-filled pipe construction has an additional environmental problem associated with the potential for oil leaks into the surrounding soil and water.

For all these reasons, utilities favor underground transmission construction only in heavily congested urban areas, or where there isn't enough room for overhead construction, or near airports where overhead transmission wires and poles could interfere with the safe landing and take-off of airplanes.

For further discussion of this subject, see the Overview “Underground Electric Transmission Lines.”

Utility Options for Transmission Lines

Some low-voltage problems can be corrected by installing special devices that regulate the voltage in an area and automatically respond to sudden low voltages caused by transmission line outages. Some line overloads can be corrected by installing larger conductors on an existing line. One option for deferring or eliminating the need for new transmission lines is Targeted Area Planning.

Targeted Area Planning

Targeted Area Planning (TAP) is a planning process that uses detailed local information on electric usage and that considers all potential locally-sited resources to meet local energy service needs economically with the smallest environmental footprint. This approach is in contrast to traditional planning which relies on large, central power plants and large transmission lines to get power to local areas.



TAP can be effective in delaying or eliminating the need for new power lines where power line need is driven by localized load growth and not “age and condition” of lines or the need for bulk energy transfer. TAP requires more detailed, area-specific information and considers a variety of resources, such as:

- targeted DSM to promote energy efficiency;
- locally-sited renewable generation;
- locally-sited fossil fuel generation; and
- education to change customer usage patterns.

TAP may have economic and environmental advantages, but it requires a large amount of local data and there may be problems in siting small power plants as well as large ones.

The major utilities in Wisconsin are part of a TAP Collaborative group along with other interested parties. Each utility has selected one planned transmission project and is conducting an analysis of TAP alternatives. Also, the utilities have agreed, and the PSC has ordered, that all future transmission projects will be screened to determine which projects are appropriate for Targeted Area Planning.

Public Input on Proposed Power Lines

The PSC actively solicits comments from government officials and the public on:

- the existence and location of resources in a power line project area;
- potential power line routes; and
- concerns about potential impacts.

The PSC notifies landowners along possible routes and asks for comments. Possible routes may change during PSC review of the case. These changes depend on the size of the project area and the complexity of the project. The route proposed by the utility at an earlier utility-sponsored public meeting may not be the one ultimately proposed by the utility or approved by the PSC. Public input can affect the PSC decisions about a project.

Communicating with the PSC

Methods of getting information to or from the PSC for a particular project may include one or more of the following:

- Calling a PSC contact person (for each project, the name is provided to you in a letter or public notification).
- Writing a letter to the PSC contact person.
- Talking to a PSC staff person at a public information meeting (sponsored by the utilities or the PSC).
- Writing a comment letter on a draft EIS.
- Providing testimony at a PSC hearing.

PSC hearings

Not all transmission cases require PSC hearings. However, for the case which does require a hearing, any individual or government unit with a point to make *must* testify at the hearing. By law, when a PSC hearing is held, the decision can be based only on the information in the testimony or exhibits of the hearing (these are called the “hearing record”). Discussion and comment letters are not part of the record and cannot be used as a basis for the decision. PSC hearings are held as close to the project area as possible to accommodate public testimony.

Environmental Impact Statement

Few transmission construction cases require an EIS, but all cases are given some type of environmental review. If there is a hearing, environmental testimony is entered by PSC staff. If an EIS is required, it becomes an exhibit in the hearing record.

Communicating with the utilities as well as the PSC

Most utilities, when looking at possible routes for power lines, seek information or comments from local government officials and landowners. Some utilities sponsor public meetings before making the final application for PSC approval. After the application is filed, then the PSC begins its official review and request for public comments.

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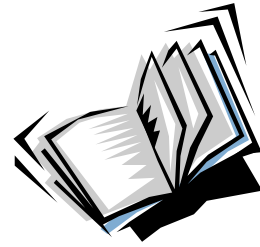
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PSC Overview Series

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- Air Quality Issues for Electric Power Generation
- Electric Energy Efficiency
- EMF—Electric and Magnetic Fields
- Environmental Impacts of Electric Transmission Lines
- How to Participate in Public Hearings
- Merchant Plants and Other Non-Utility Generation
- Nuclear Power Plant Decommissioning and Radioactive Waste Disposal
- Power Plant Siting
- Power Plants
- Renewable Energy Resources
- Right-of-Way and Easements for Electric Facility Construction
- Underground Electric Transmission Lines



To obtain any of these Overviews, contact Gail Hanson, by phone (608) 267-2896 or e-mail hansog@psc.state.wi.us, at the Public Service Commission or check our home page at : <http://www.psc.state.wi.us>.

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